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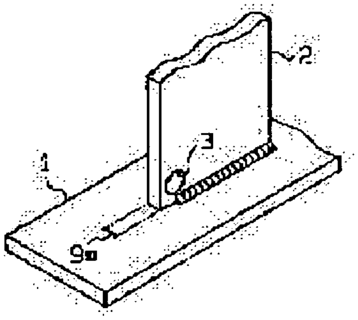
(54) **METHOD FOR RELIEVING CONCENTRATION OF STRESS OF WELDING JOINT**

(57)Abstract:
PURPOSE: To reduce the manufacturing cost and to relieve the concentration of stress from a welding joint part.
CONSTITUTION: A hole 3 to relieve the concentration of stress is formed at the neighborhood of the corner of a front protector 2 of flat steel in contact with a front axle plate 1 as a base material and welding is carried out from a position corresponding to a small distance between the peripheral surface of the hole 3 to relieve the concentration of stress and the surface coming into contact with the front axle plate 1 toward the direction of the other corner where the hole 3 to relieve the concentration of stress is not formed to join the front axle plate 1 and the protector 2 and to relieve the concentration of stress in the welding joint part A.



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DESCRIPTION OF DRAWINGS

[Drawing 1] It is the partial perspective view showing the condition of having carried out the welded joint of the front protector to the front-axle plate.

[Drawing 2] It is the load diagram and bending moment diagram of the joint section of one example.

[Drawing 3] It is the perspective view showing the frame structure of a fork lift truck.

[Drawing 4] It is the partial perspective view in which showing the conventional technique and showing the condition of having carried out the welded joint of the front protector which consists of flat steel which does not perform appearance processing to the front-axle plate.

[Drawing 5] It is the side elevation and its bending moment diagram at the time of carrying out the welded joint of the front protector which consists of flat steel which does not perform appearance processing to a front-axle plate.

[Drawing 6] It is the partial perspective view showing the condition of having carried out the welded joint of the front protector which consists of flat steel which performed appearance processing to the front-axle plate.

[Drawing 7] (a) is the side elevation and its bending moment diagram at the time of carrying out the welded joint of the flat steel which performed appearance processing to a base material, and its (b) is the flat steel at the time of carrying out foreword strange [ of the aspect change of flat steel ] by the approach (a) differs, and the side elevation of a base material.

[Description of Notations]

1 [ -- Welded joint section ] -- The front-axle plate as a base material, 2 -- The front protector as flat steel, 3 -- The hole for stress concentration relaxation, A

DETAILED DESCRIPTION

[0001]

[Industrial Application] This invention relates to the stress concentration relaxation approach of a welded joint.

[0002]

[Description of the Prior Art] Conventionally, as a ****** joint used for welding, a corner joint, a T joint, a flange coupling, etc. are common.

[0003] The degree of stress concentration which joins the welded joint section by said T joint when a base material and flat steel are joined by welding is large. Since the aspect change in the welded joint section A of a base material 51 and flat steel 52 is rapid as the reason as shown in the load diagram and bending moment diagram (Bending Moment Diagram) of drawing 4 and drawing 5 , it is thought that the degree of stress concentration became large.

[0004] Then, as shown in drawing 6 , larger flat steel than the width of face of the aforementioned flat steel 52 was used, and near the buttock of the flat steel was shaved off so that a loose curve might be drawn by appearance processing. That is, there is an approach makes only the die length of the welded joint section A longer than the above-mentioned flat steel 52, and the aspect change of the part is [ an approach ] made to carry out foreword strange, without changing the width of face of the original flat steel 52.

[0005] Consequently, as shown in drawing 7 (a), whenever [ stress concentration / of the welded joint section A when welding the flat steel 52 formed so that an aspect change might carry out foreword strange by appearance processing to a base material 51 ] is eased sharply. Furthermore, when foreword strange [ of the aspect change of the welded joint section A ] is carried out for the tip of this flat steel 52 by the smooth curve by grinder processing, it becomes possible to aim at relaxation of stress concentration more.

[0006]
[Problem(s) to be Solved by the Invention] However, since fusing performs appearance processing of the flat steel 52 shown in said drawing 6 and drawing 7 (a) and it is easy to transform flat steel 52 with the fusing heat at the time of the processing, the yield worsens. Moreover, since that tip tends to deform the tip of this flat steel 52 with frictional heat with a grinder etc. also about the time of processing by grinder processing, the yield worsens.

[0007] Furthermore, while the yield worsens since there are many amounts of the removed flat steel 52 when appearance processing is performed to said flat steel 52 and a part is removed, the processing process is separately needed. Consequently, there was a problem that a manufacturing cost increased.

[0008] Moreover, the long hole-like slot 53 is formed in the flat steel 52 shown in drawing 7 (b) with an end mill etc., and there is also the approach of carrying out foreword strange [ of the aspect change of flat steel 52 ]. However, when the distance H between the end faces which contact the peripheral surface and base material 51 of a slot 53 is narrowly formed in order to make an aspect change small more even if the yield becomes good in this case, there is a problem that the reinforcement of that part falls.

[0009] This invention is made in order to cancel the above-mentioned trouble, and the purpose is to offer the stress concentration relaxation approach of the welded joint
which can ease the stress concentration of the welded joint section while being able to aim at reduction of a manufacturing cost.

[0010]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, in this invention, the hole for stress concentration relaxation is formed near the buttock of the flat steel which contacts a base material. From the location corresponding to a short distance, the distance between the fields which contact the peripheral surface and said base material of said hole for stress concentration relaxation welding in the direction of a buttock of another side in which said hole for stress concentration relaxation is not formed, joining said base material and flat steel, and having eased the stress concentration in the welded joint section – the – a summary is carried out.

[0011]

[Function] According to this invention, foreword strange [ of the aspect change of the part ] is carried out to the flat steel in which a joint is carried out to a base material by welding by having formed the hole for stress concentration relaxation. Therefore, even if it carries out the welded joint of this flat steel to a base material, the degree of stress concentration which joins that welded joint section is eased.

[0012] Moreover, since it carries out foreword strange [ of the cross section of flat steel ] by the hole for stress concentration relaxation, it differs and is hard to carry out deformation of a part by which foreword strange was carried out in appearance processing by fusing etc.

[0013]

[Example] Hereafter, one example which materialized this invention to the frame structure of a fork lift truck is explained based on drawing 1 - drawing 3 .

[0014] As shown in drawing 3 , the front protector 2 which consists of flat steel is welded to the front-axle plate 1 by the T joint (this drawing A section). This example explains the time of aiming at relaxation of the stress concentration in the welded joint section A of this front-axle plate 1 and the front protector 2.

[0015] As shown in drawing 1 , the joint (T joint) of the front protector 2 which consists of flat steel which does not perform appearance processing explained by the above-mentioned former is carried out to the front-axle plate 1 as a base material by welding. The hole 3 for stress concentration relaxation is formed near the buttock of the method of one which contacts the front accelerator plate 1 of said front protector 2. This hole 3 for stress concentration relaxation is formed at the punching process same at the time of formation of holes for anchoring, such as a bulb attached in the rear face of the front protector 2, and a pipe (neither is illustrated).

[0016] By having formed the hole 3 for stress concentration relaxation in said front protector 2, it can carry out foreword strange [ of the aspect change of the welded joint section A ]. Moreover, since it can differ in appearance processing by fusing etc. and can carry out foreword strange [ of the aspect change of flat steel ] by punching processing, the deformation of a part by which foreword strange was carried out does not occur.

[0017] Consequently, whenever [ stress concentration / of the welded joint section A at the time of welding the front protector 2 in which the hole 3 for stress concentration relaxation of this example was formed to the front-axle plate 1 ] is reduced more sharply than whenever [ stress concentration / of the conventional welded joint section A ] (refer to drawing 5 ), as shown in drawing 2 (in the case of 9mm in thickness of flat steel, and 25mm diameter of the hole for stress concentration relaxation, it decreases about 15%).

[0018] In this example, since said hole 3 for stress concentration relaxation was formed in other punching processes and coincidence at the front protector 2, it does not need to establish separately the punching process for forming the hole 3 for stress concentration relaxation. Moreover, since there are few amounts of cutting of the flat steel at the time of formation of the hole 3 for stress concentration relaxation more sharply than the amount of cutting of the flat steel at the time of carrying out appearance processing of the flat steel, and being made to carry out foreword strange [ of the aspect change of the welded joint section A ], the yield becomes good. Consequently, reduction of cost can be aimed at sharply. Moreover, since whenever [ stress concentration ] can be reduced sharply, a more reliable fork lift truck can be manufactured.

[0019] In addition, this invention is not limited to the above-mentioned example, and can also be constituted in the range which does not deviate from the meaning of invention as follows, for example.

[0020] (1) In the above-mentioned example, although this invention was materialized by the frame structure of a fork lift truck, this may be materialized with other welded joints.
(2) In the above-mentioned example, the hole 3 for stress concentration relaxation may materialize this by a long hole etc., although shape was taken with the right circle.
(3) In the above-mentioned example, although the class of joint was materialized by the T joint, this may be materialized with other corner joints, flange couplings, etc.

[0021] (4) The thickness of flat steel in the above-mentioned example and the diameter of the hole 3 for stress concentration relaxation may be changed suitably.

[0022]
[Effect of the Invention] According to this invention, as explained in full detail above, while preventing deformation of flat steel at the time of processing at the time of carrying out foreword strange [ of the aspect change of flat steel ], reduction of a manufacturing cost can be aimed at and the outstanding effectiveness that the stress concentration of the welded joint section can be eased is further done so.

[Translation done.]

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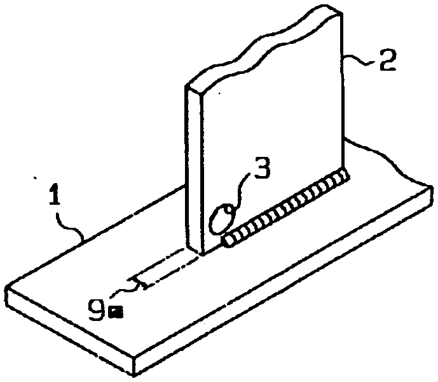
# (54)【発明の名称】　溶接継手の応力集中緩和方法

(57)【要約】

【目的】製造コストの低減を図ることが可能であるとともに、溶接継手部の応力集中を緩和することができる溶接継手の応力集中緩和方法を提供すること。

【構成】母材としてのフロントアクスルプレート１と当接する平鋼としてのフロントプロテクタ２の隅角付近に応力集中緩和用穴３を形成し、その応力集中緩和用穴３の周面と前記フロントアクスルプレート１に当接する面との間の距離が短い距離に対応する位置から、応力集中緩和用穴３が形成されていない他方の隅角方向へ溶接を施してフロントアクスルプレート１とフロントプロテクタ２とを接合し、その溶接継手部Ａにおける応力集中を緩和するようにする。



【特許請求の範囲】

【請求項１】　母材と当接する平鋼の隅角付近に応力集中緩和用穴を形成し、前記応力集中緩和用穴の周面と前記母材に当接する面との間の距離が短い距離に対応する位置から、前記応力集中緩和用穴が形成されていない他方の隅角方向へ溶接を施して前記母材と平鋼とを接合し、その溶接継手部における応力集中を緩和するようにした溶接継手の応力集中緩和方法。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、溶接継手の応力集中緩和方法に関するものである。

【０００２】

【従来の技術】従来、溶接に用いられている継手としては、カド継手やT形継手、フランジ継手等が一般的である。

【０００３】前記T形継手によって母材と平鋼とを溶接により接合した場合、その溶接継手部に加わる応力集中の度合いが大きい。その理由としては、図4及び図5の荷重線図及び曲げモーメント線図（Bending Moment Diagram）に示すように、母材５１と平鋼５２との溶接継手部Aにおける断面変化が急激であるため応力集中の度合いが大きくなったと考えられる。

【０００４】そこで、図6に示すように、前記の平鋼５２の幅よりも大きい平鋼を使用し、その平鋼の隅角付近を外形加工により緩やかな曲線を描くように削り取った。すなわち、本来の平鋼５２の幅を変えずに、溶接継手部Aの長さのみを上記の平鋼５２よりも長くし、その部分の断面変化が序変するようにする方法がある。

【０００５】その結果、図7（ａ）に示すように、外形加工により断面変化が序変するように形成された平鋼５２を母材５１に溶接したときの溶接継手部Aの応力集中度は大幅に緩和されている。さらに、この平鋼５２の先端をグラインダ加工により滑らかな曲線で溶接継手部Aの断面変化を序変した場合には、より応力集中の緩和を図ることが可能となる。

【０００６】

【発明が解決しようとする課題】しかしながら、前記図6及び図7（ａ）に示す平鋼５２の外形加工は溶断により行うことから、その加工時における溶断熱で平鋼５２が変形しやすいため、歩留りが悪くなる。また、この平鋼５２の先端をグラインダ加工による加工時についてもグラインダとの摩擦熱等で、その先端が変形しやすいことから歩留りが悪くなる。

【０００７】さらに、前記平鋼５２に外形加工を施して一部を取り除いた場合には、その取り除いた平鋼５２の量が多いことから歩留りが悪くなるとともに、その加工工程が別途に必要となる。その結果、製造コストが増加するという問題があった。

【０００８】また、図7（ｂ）に示す平鋼５２にエンドミル等により長孔状の溝５３を形成し、平鋼５２の断面変化を序変する方法もある。しかし、この場合、歩留りは良くなっても、より断面変化を小さくするために、溝５３の周面と母材５１に当接する端面との間の距離Hを狭く形成した場合には、その部分の強度が低下するという問題がある。

【０００９】本発明は上記問題点を解消するためになされたものであって、その目的は製造コストの低減を図ることが可能であるとともに、溶接継手部の応力集中を緩和することができる溶接継手の応力集中緩和方法を提供することにある。

【００１０】

【課題を解決するための手段】上記目的を達成するために、本発明では、母材と当接する平鋼の隅角付近に応力集中緩和用穴を形成し、前記応力集中緩和用穴の周面と前記母材に当接する面との間の距離が短い距離に対応する位置から、前記応力集中緩和用穴が形成されていない他方の隅角方向へ溶接を施して前記母材と平鋼とを接合し、その溶接継手部における応力集中を緩和するようにしたことをその要旨する。

【００１１】

【作用】本発明によれば、母材と溶接により継手される平鋼に、応力集中緩和用穴を形成したことにより、その部分の断面変化が序変される。従って、この平鋼を母材に溶接継手しても、その溶接継手部に加わる応力集中の度合いが緩和される。

【００１２】また、応力集中緩和用穴により平鋼の断面を序変させていることから、溶断による外形加工等とは異なり、序変された部分の変形がしにくい。

【００１３】

【実施例】以下、本発明をフォークリフトのフレーム構造に具体化した一実施例を図１〜図３に基づいて説明する。

【００１４】図3に示すように、フロントアクスルプレート１には、平鋼からなるフロントプロテクタ２がT形継手によって溶接されている（同図A部）。本実施例では、このフロントアクスルプレート１とフロントプロテクタ２との溶接継手部Aにおける応力集中の緩和を図る際の説明をする。

【００１５】図1に示すように、母材としてのフロントアクスルプレート１には、上記従来で説明した外形加工を施さない平鋼からなるフロントプロテクタ２が溶接によって継手（T形継手）されている。前記フロントプロテクタ２のフロントアクセルプレート１と当接する１方の隅角付近には、応力集中緩和用穴3が形成されている。この応力集中緩和用穴3は、フロントプロテクタ２の裏面に取付けられるバルブやパイプ（いずれも図示せず）等の取付け用穴の形成時に同じ穴あけ工程で形成される。

【００１６】前記フロントプロテクタ２に応力集中緩和

用穴３を形成したことにより、溶接継手部Ａの断面変化を序変させることができる。また、溶断による外形加工等とは異なり、穴あけ加工で平鋼の断面変化を序変させることができるので、序変された部分の変形が発生しない。

【００１７】その結果、本実施例の応力集中緩和用穴３が形成されたフロントプロテクタ２を、フロントアクスルプレート１に溶接した際の溶接継手部Ａの応力集中度が、図２に示すように、従来の溶接継手部Ａの応力集中度（図５参照）よりも大幅に低減される（平鋼の厚さ９ｍｍ、応力集中緩和用穴の直径２５ｍｍの場合において約１５％低減）。

【００１８】本実施例では、前記応力集中緩和用穴３は、他の穴あけ工程と同時にフロントプロテクタ２に形成したので、応力集中緩和用穴３を形成するための穴あけ工程を別途に設ける必要がない。また、応力集中緩和用穴３の形成時の平鋼の切削量は、平鋼を外形加工して溶接継手部Ａの断面変化を序変するようにした場合の平鋼の切削量よりも大幅に少ないので歩留りが良くなる。その結果、大幅にコストの低減を図ることができる。また、応力集中度を大幅に低減できるので、より信頼性のあるフォークリフトを製造することができる。

【００１９】なお、本発明は上記実施例に限定されるものではなく、発明の趣旨を逸脱しない範囲で例えば次のように構成することもできる。

（１）上記実施例では、本発明をフォークリフトのフレーム構造で具体化したが、これをその他の溶接継手で具体化してもよい。

【００２０】（２）上記実施例では、応力集中緩和用穴３は正円で具体化したが、これを長孔等で具体化してもよい。

（３）上記実施例では、継手の種類をＴ形継手で具体化したが、これをその他のカド継手やフランジ継手等で具体化してもよい。

【００２１】（４）上記実施例での、平鋼の厚さ及び応力集中緩和用穴３の直径を適宜変更してもよい。

【００２２】

【発明の効果】以上詳述したように、本発明によれば、平鋼の断面変化を序変する際の加工時に、平鋼の変形を防止するとともに、製造コストの低減を図ることができ、さらには、溶接継手部の応力集中を緩和することができるという優れた効果を奏する。

【図面の簡単な説明】

【図１】フロントプロテクタをフロントアクスルプレートに溶接継手した状態を示す部分斜視図である。

【図２】一実施例の継手部の荷重線図及び曲げモーメント線図である。

【図３】フォークリフトのフレーム構造を示す斜視図である。

【図４】従来技術を示し、外形加工を施さない平鋼からなるフロントプロテクタをフロントアクスルプレートに溶接継手した状態を示す部分斜視図である。

【図５】外形加工を施さない平鋼からなるフロントプロテクタをフロントアクスルプレートに溶接継手した際の側面図とその曲げモーメント線図である。

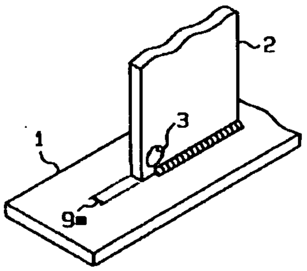
【図６】外形加工を施した平鋼からなるフロントプロテクタをフロントアクスルプレートに溶接継手した状態を示す部分斜視図である。

【図７】（ａ）は外形加工を施した平鋼を母材に溶接継手した際の側面図とその曲げモーメント線図であり、（ｂ）は（ａ）とは異なる方法で平鋼の断面変化を序変した際の平鋼及び母材の側面図である。

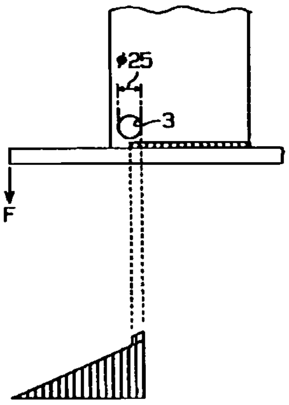
【符号の説明】

１…母材としてのフロントアクスルプレート、２…平鋼としてのフロントプロテクタ、３…応力集中緩和用穴、Ａ…溶接継手部

【図１】



【図２】



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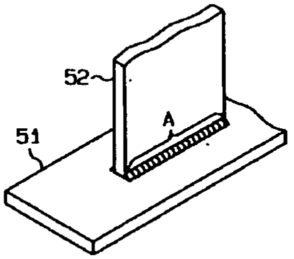

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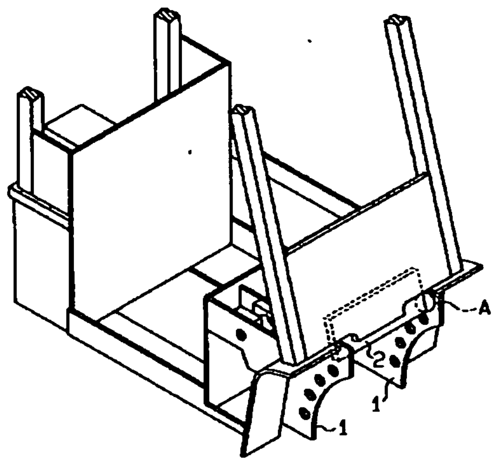

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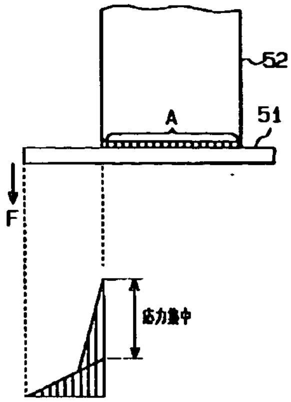

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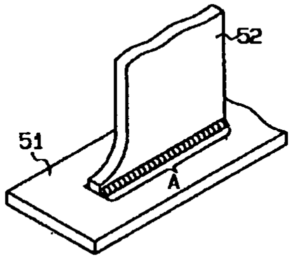

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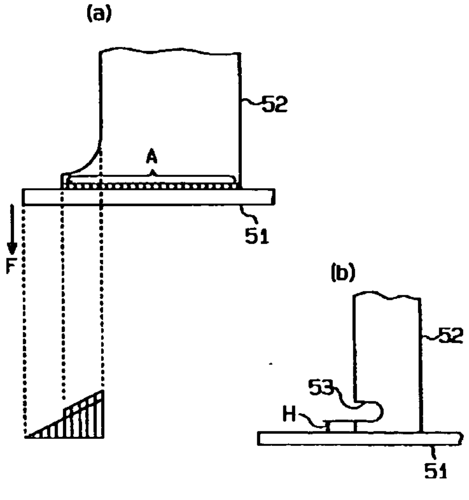

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